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**HAZARDOUS MATERIAL LIFE-CYCLE COST MODEL**

**SYSTEM USER/OPERATORS GUIDE**

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# **Hazardous Material Life-Cycle Cost Model**

## **System User/Operators Guide**

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## Summary

The Hazardous Material Life-Cycle Cost (HMLCC) Model was developed to estimate the total life-cycle costs of using various hazardous materials in the construction, maintenance, and repair of U.S. Naval systems and facilities. The model estimates those costs derived from the need to protect the health and safety of workplace personnel and the need to protect the environment. The purpose of this guide is to provide users with a detailed description of the system as well as the basic structure and features of the HMLCC Model and instructions on how to use the system.

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## Section 1 Introduction

### 1.1 Purpose of the Hazardous Material Life-Cycle Cost Model

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In 1987, the Chief of Naval Operations (CNO) instructed all Navy commands to reduce the amount of hazardous waste by 50 percent by December, 1992, using 1987 levels as their baseline [1]. To accomplish these goals Navy personnel are implementing management control practices and up-to-date technology. The Hazardous Material Life-Cycle Cost (HMLCC) Model was developed to assist Navy personnel in conducting cost analyses when making decisions about the procurement of various hazardous materials. The HMLCC Model aggregates the costs derived from actions taken to protect the health of the worker or to preserve the environment when a particular hazardous material is used.

### 1.2 Cost Factors

---

The primary cost of using non-hazardous materials is procurement cost; however, when using hazardous materials (HM) added expenses are incurred because of the need to protect the individual's health and the environment. The added expenses that elevate the basic procurement cost of a material can be grouped into a set of cost factors. Cost factors identified by interviews with experts in the field (see The System Managers Guide) were included in the initial HMLCC model. These are as follows:

**Claims and  
Compensation**

Processing claims, monitoring cases, conducting interventions to resolve problems, assessment of liability, and providing appropriate payment.

**Disposal**

Discard, permanent containment, or treatment to eliminate the toxic potential of a hazardous substance, product, or waste.

**Engineering  
Controls**

Construction, maintenance, and repair of structural equipment used to prevent personal and environmental exposures to hazardous materials.

**Fines and Penalties**

Costs incurred because of federal, state, or local safety and environmental regulatory violations, including improper or incomplete recordkeeping, unsafe working conditions, and environmental pollution.

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<b>Medical Surveillance</b>	Medical consultations, examinations, tests, and procedures, including baseline and periodic, as well as event driven medical encounters.
<b>Medical Treatment</b>	Medical care for occupational injuries or illnesses due to exposure to a hazardous substance, product, or waste.
<b>Permits and Certification</b>	Local, state, and federal permits required for transportation, storage, and use of certain hazardous materials at a facility.
<b>Personal Protective Equipment (PPE)</b>	Gear that is issued to individual workers to prevent exposure to hazardous materials, including maintenance, inspection, distribution, replacement, and inventory.
<b>Procurement</b>	The initial cost of the material.
<b>Spill Containment and Cleanup</b>	Responses to spills of hazardous materials including costs of equipment and personnel.
<b>Storage</b>	Storage of the hazardous material before use and storage of any resulting hazardous waste before disposal.
<b>Training</b>	Instructions regarding the legal requirements pertaining to hazardous materials, and information regarding methods and procedures for minimizing the risk of exposure to a hazardous material.
<b>Workplace Monitoring</b>	Surveys, inspections, and monitoring of workplace, processes, materials, and personnel for the purpose of maintaining the health and safety of workers, and to protect the environment.

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### **1.3 Cost Elements**

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Cost factors are broad categories of individual cost components that make up the total HM use cost. Cost elements are sub-categories of cost factors. Cost elements make up the cost factors, similar to the way cost factors make up the total HM use cost. For example, personal protective equipment (PPE) is a cost factor, however, there are many different kinds of personal protective equipment such as, gloves, respirator, and boots. These are the cost elements for the cost factor PPE. Thus, the cost of a factor is computed as the summation of the cost elements associated with the factor.

### **1.4 Cost Items**

---

The expenditure for a cost element depends on the specific item acquired. For example, gloves may cost between \$1.00 and \$25.00 per pair depending on the type of glove purchased. The various products used to meet the requirement of a cost element are called cost items. Each cost item has a unique price.



---

## **Section 2 HMLCCM Software Summary**

### **2.1 Programming Language**

---

The HMLCCM Software was developed using FoxPro. FoxPro is a database management system created for the personal computer.

### **2.2 Security/Privacy**

---

The security module will maintain user passwords which allow logon access to the HMLCCM program and database files. Menu options are assigned to the user through a security key system in FoxPro. HMLCCM does not collect or store Privacy Act data.

### **2.3 Maintenance**

---

The primary maintenance functions consist of security, file and format definition, user file updates, and data initialization.

### **2.4 System Organization**

---

The HMLCCM has four modules or user options (described in Section 4), which include Cost Analysis, Reference, Set Parameters, and System Maintenance. To access the Set Parameter option a password is required.

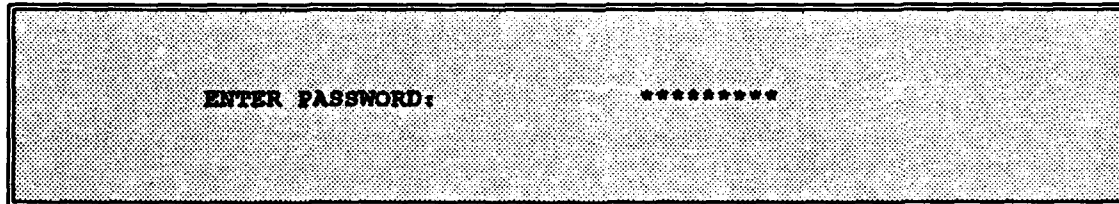
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## Section 3 Accessing the System

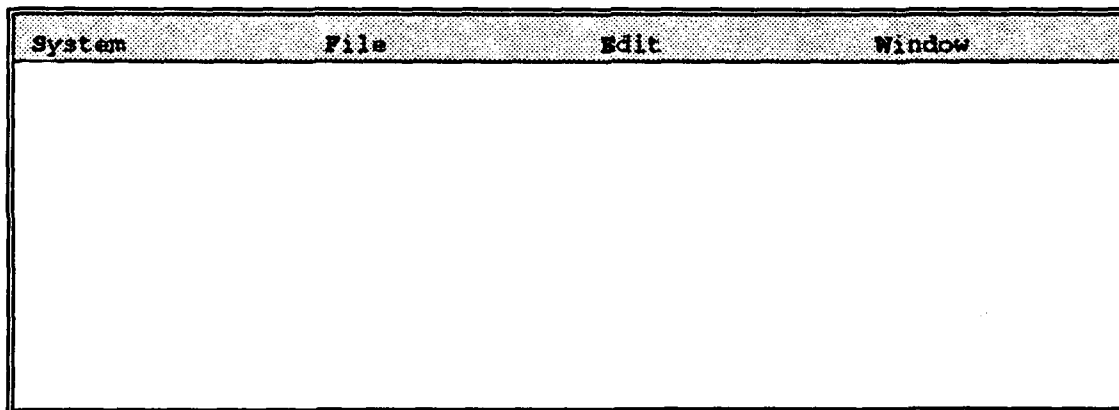
### 3.1 Logon to HMLCCM

---

At the MS-DOS prompt, (C:\HMLCCM) type HMLCCM and the security prompt will display:



Type in the password and press "Enter" or "Carriage Return" <CR> . If the password is unknown press <CR>. The password allows the user to access the set parameters option. If the user is unable to provide the appropriate password, reference, maintenance, and cost analysis will be the only options accessed. A brief greeting will display before the following "desktop" appears:



The parts of the menu system are shown on page 6, along with steps for choosing menu options with the keyboard and mouse. If your System does not have a mouse you will need to use the keyboard.

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## 3.2 Choosing Menu Options with the Keyboard

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Selecting Menu Pads and Menu Options are executed differently when using the keyboard. The following are instructions on how to select Menu Pads and Menu Options with the keyboard.

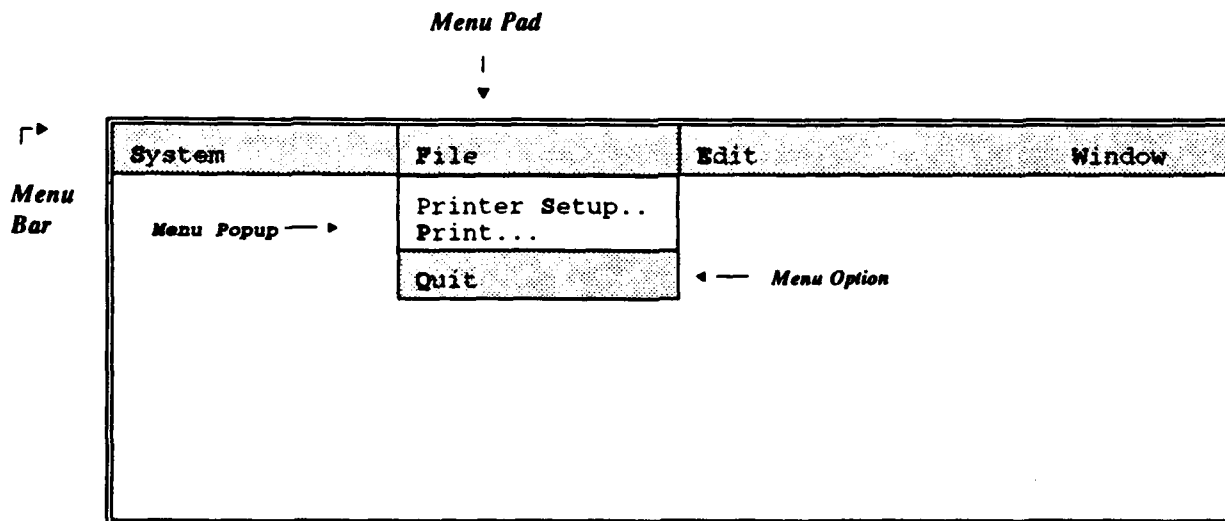
### 3.2.1 Selecting Menu Pads

There are four Menu Pads available to the user: System, File, Edit and Window. Press the **Alt** key in conjunction with the first letter of the menu pad you want to select. For example if you want to access the **F**ile menu pad press **Alt F**.

### 3.2.2 Selecting Menu options

A Menu popup appears, containing a list of menu options, when a particular menu pad is selected. There are two ways to select a menu option using the keyboard:

1. Press the **↑** or **↓** keys to highlight the desired Menu Option and press **<CR>**.
2. Type the bold letter of the Menu Option you want and press **<CR>**.



---

## 3.3 Choosing Menu Options with the Mouse

---

1. Point to the menu pad and press the **Left** mouse button to display the menu popup.
2. Point to the desired option and press the **Left** mouse button.

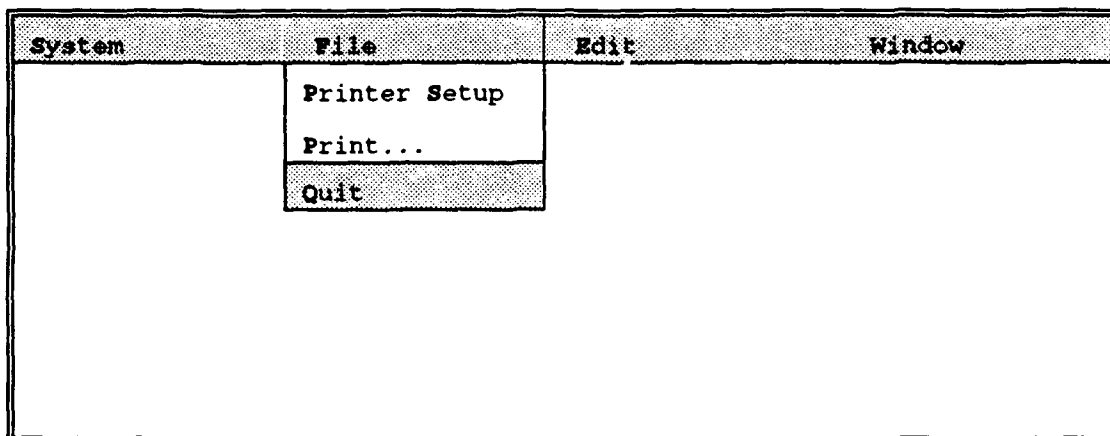
---

### 3.4 Logout of HMLCCM

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To return to the MS-DOS prompt

1. Choose **Quit** from the **File** menu pad.



## Section 4 Systems Operation

### 4.1 Cost Analysis

To calculate how much it will cost to use a particular hazardous material you will first need to define the circumstances in which the substance will be used. For example, you may use 5 gallons of lead-based paint or 4 gallons of PD-680. Specification of the circumstances for using a hazardous material is called the hazardous material scenario. Each scenario consists of one or more steps. For each step of a scenario, a material, phase, process, number of people, number of days, and quantity of material must be defined. To create a scenario follow the instructions outlined below.

1. Choose **HMLCCM** from the **System** menu pad.

An option menu will appear on the screen.

2. Choose **Cost Analysis** from the option menu.

*This will direct you to the Build Hazmat Scenario prompt as shown below.*

System	File	Edit	Window
Help... F1			
Calculator			
HMLCCM *	Cost Analysis *	Build HAZMAT Scenario	
	Reference		
	System Maintenance		
	Set Parameters		

3. Press <CR>.

*The following box will appear:*

Cost Analysis				
Scenario:	<input type="text"/>			
<New>	<Retrieve>	<Delete>	<Browse>	<Cancel>

---

You are now in the Cost Analysis option. There are two things you can do. You can either define a new scenario or retrieve an already existing scenario.

#### 4.1.1 Define a New Scenario

1. Type in a file name and press <CR>.

The cursor should default to the sub menu below and highlight New.

2. Select New from the sub menu below and press <CR>.

*The following screen will display:*

HAZARDOUS MATERIAL SCENARIO			
Step # 1	Scenario: 1 Example		
Material:		< Add >	
Phase:		< Edit >	
Process:		< Next >	
		<Previous>	
		< Exit >	
Number of Employees:	0	Number of days:	0
Quantity of material:	0	Unit:	
< Save > <Cancel>			

**Note:** The users can only input materials, phases and processes that have previously been defined. To insure that you are using an item that has previously been defined type ? <CR> to access the list of choices.

3. Type in the name of the hazardous material used and press <CR>.
4. Type in the phase and press <CR>.
5. Type in the process and press <CR>.
6. Type in the number of employees who performed the process and press <CR>.

---

7. Type in the number of days that the process took to complete and press <CR>.

8. Type in the quantity of material used in the process and press <CR>.

**Note:** The unit of material is defined when the material is defined, therefore, the unit will never need to be input at the hazardous material scenario screen.

9. Select Save on the sub menu below and press <CR>.

10. Select Exit on the side menu and press <CR> (Skip to Section 4.1.3 step 5).

#### **4.1.2 Defining a Scenario with Multiple Steps**

A scenario consists of one or more steps, where each step specifies a material, phase, process, number of people involved, the duration of the task, and quantity of material. Steps enable the user to calculate costs for the separate components of a complex process. For example, one may want to determine the cost of painting an airplane where both the construction cost and maintenance cost are of interest. The components or steps of this process might include applying the paint during construction, and then stripping and repainting during the maintenance phase. Therefore, the hazardous material scenario would consist of the following steps;

**Step 1:**

Material: *Lead paint*  
Phase: *Construction*  
Process: *Spray Painting*

**Step 2:**

Material: *Methylene chloride*  
Phase: *Maintenance/Repair*  
Process: *Paint stripping*

**Step 3:**

Material: *Lead paint*  
Phase: *Maintenance/Repair*  
Process: *Spray painting*

Once you have identified the steps you will need to enter them into the HMLCC model.

---

First follow the instructions in 4.1.1 (Define a New Scenario) for entering in step 1. After you have defined a scenario you will notice that at the top left corner will be Step 1 and the top right corner will be the scenario name. To create another step follow the instructions below:

1. At the scenario dialog box, select the scenario you just created by typing in the name.

The Hazardous material scenario material dialog box will appear on the screen.

2. Select **Add** on the side menu.
3. Input the material, phase, process, quantity of material, number of employees and days.

After you have done this you will notice that the step is now #2.

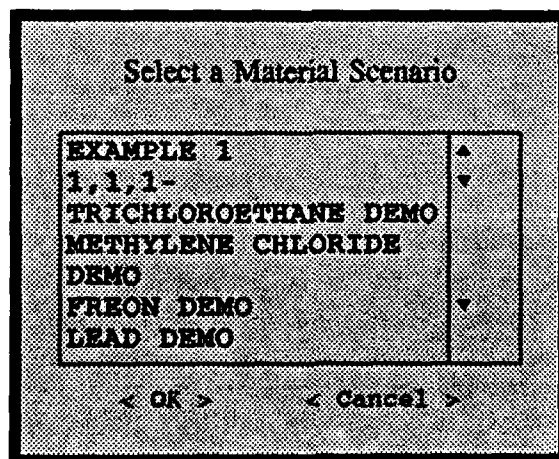
4. Select **Save** on the sub menu below and press <CR>.
5. Select **Exit** on the side menu and press <CR> (Skip to section 4.1.3 step 5).

#### 4.1.3 Retrieving a Scenario

If you do not want to define a new scenario, you have the option of accessing a scenario in the database that has been previously defined. To retrieve a scenario that already exists follow the instructions below.

1. Type ? <CR>

*A list of all the scenarios in the database will appear on the screen (shown below).*





2. Select by using the ↑ or ↓ keys until the scenario you want to retrieve is highlighted.

3. Press <CR>.

The cursor will default to the sub menu below and highlight retrieve.

4. Select retrieve and Press <CR>.

A dialog box will appear asking you if you want to do computations now.

5. Press Yes and <CR>.

The following box will display:

COMPUTE COST VALUE			
Estimated Cost	Scenario:	1 Example	Estimated Variance
[ ]	for step:	<input type="text"/>	[ ]
[ ]	for Factor:	<input type="text"/>	[ ]
[ ]	for Factor:	<input type="text"/> at step:	<input type="text"/> [ ]
[ ]	for Phase:	<input type="text" value="CONSTRUCTION"/>	[ ]
# of iterations	Total of Scenario cost:		( ) Yes ( ) No
200	< OK > <Browse> <Cancel>		

**Note:** For a review of the terms used on this menu see Appendix A.

#### 4.1.4 Selecting Computation Options

This option allows the user to calculate the estimated cost of a scenario or a portion of a scenario. In addition, the user can derive variance for the cost estimate using a bootstrap analysis.

---

#### 4.1.4.1 Cost Estimate

The cursor will appear in the first cost box. If you are using a keyboard use the ← and → keys to move to the next option.

The following list describes the functions of each of the cost boxes.

- Cost box 1:** Computes the estimated cost for all steps in the scenario or only one step.
- Cost box 2:** Computes the estimated cost for factors across all steps.
- Cost box 3:** Computes the estimated cost for a particular factor at a particular step.
- Cost box 4:** Computes the estimated cost for a particular phase.

If you are interested in the total scenario cost, for example the total cost to paint an airplane, select the "Total of scenario cost" radio button at the bottom of the screen.

For selecting the cost computation option follow the instructions below;

1. Select the cost box on the left side of the screen by positioning the cursor on the box and pressing <CR>.
2. Move the cursor to the option box parallel to the compute box and press <CR>.

A dialog box will appear displaying your options.

3. Highlight the option you want and press <CR>.

**Note:** If your scenario includes more than one step and you have defined these steps you will have the option to compute cost for all the steps or for only one of the steps. If you have not defined more than one step you will only be able to compute for that particular step.

---

#### 4.1.4.2 Selecting Variance Options

The variance box allows the user to conduct a bootstrap analysis to determine the variance of a cost estimate. The results are presented as the mean and standard deviation of a set of samples. The user determines the number of samples by specifying the number of iterations.

**Note:** The system will only allow you to estimate the variance of one cost factor at a time.

For selecting a variance option follow the instructions below:

1. Move the cursor to the variance box and press <CR>.

Finish selecting any cost options before you continue.

2. Select the # of iterations by entering the number in the box to the left and press <CR>.

**Note:** the default value for iterations is 200. Using this value will require several minutes of compute time. The user may select a smaller value if desired, however, larger values will yield more accurate estimates.

3. Select <OK> on the sub menu below and press <CR>.

A dialog box will appear with several variance options.

4. Select by highlighting the option and press <CR>.

A message window will appear with "Calculating" in the box until the estimated cost and variance results appear.

---

## 4.2 On-Line Hazardous Materials Reference

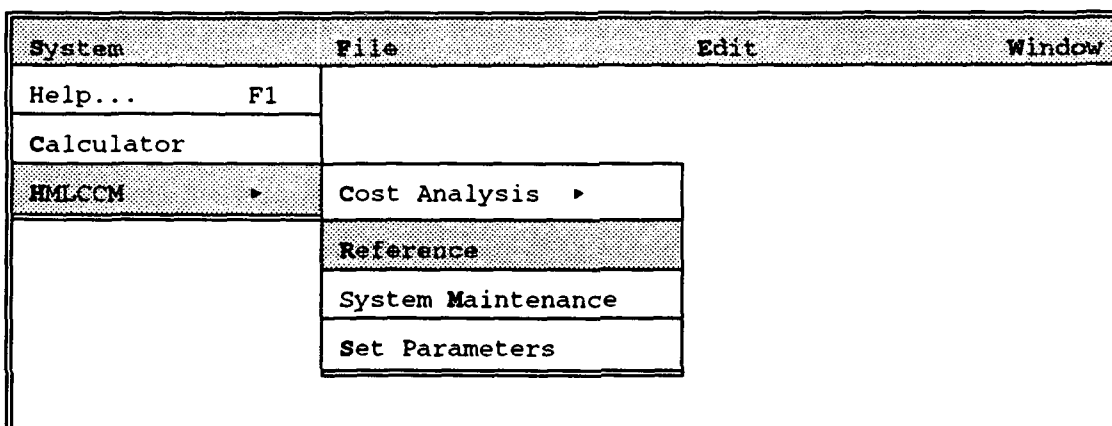
---

An on-line reference option is available which allows the user to retrieve information, such as; Synonyms/Trade names, Common uses, Descriptions, Chemical/Physical properties, Occupational exposures, Exposure limits, Health hazards, Medical surveillance, Special tests, Personal protective equipment, and Treatments. To access this information follow the steps below.

1. Choose **HMLCCM** from the **System** menu.

An option menu will appear on the screen.

2. Choose **Reference** from the option menu.



*The following box will appear:*

The screenshot shows a dialog box with a label 'MATERIAL:' followed by a text input field. Below the input field is a prompt '(Enter a Material or '?' for Help)'. At the bottom of the dialog box are two buttons: '< Ok >' and '<Cancel>'. The input field contains a question mark '?'.

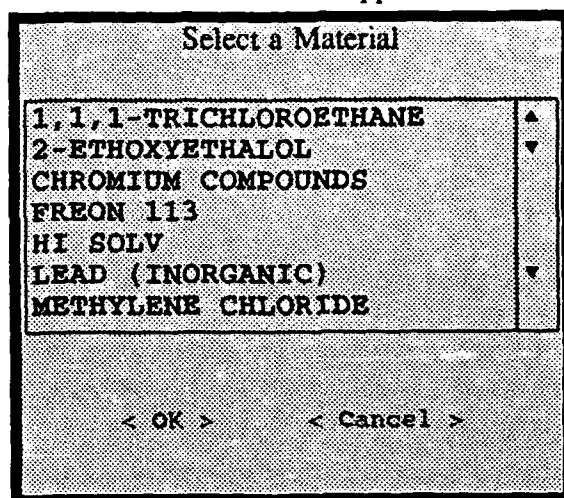
MATERIAL:

(Enter a Material or '?' for Help)

< Ok > <Cancel>

3. Type ? and press <CR>.

A list of all the materials in the database will appear on the screen (shown below).



4. Select by using the ↑ or ↓ keys until the material you want is highlighted.
5. Press <CR>.

The cursor will default to the sub menu below and highlight OK.

6. Select OK and press <CR>.

The screen will display the hazardous material you selected and the information divided into the 11 subcategories previously mentioned. To scroll down the screen use the ↑ and ↓ keys.

#### 4.2.1 Print On-line Reference Information

Occasionally you will want to print the reference information that appears on the screen to do this follow the instructions below.

At the on-line reference screen;

1. Press **shift** and **tab** at the same time to move the cursor to the sub menu below.
2. Select **Print** and press <CR>.

#### 4.2.2 Exit On-line Reference

1. Press **shift** and **tab** at the same time to move the cursor to the sub menu below.
2. Select **Exit** and press <CR>.

---

## 4.3 Maintenance

---

Occasionally you will want to back-up your files onto floppy disks or to up-load data that was done on another computer. To perform these functions follow the instructions listed below:

### 4.3.1 Backing-up your files

1. Choose **HMLCCM** from the **System** menu.

An option menu will appear on the screen.

2. Choose **System Maintenance** from the option menu.

Another option menu will appear on the screen.

3. Choose **Back-Up (floppy)** from the option menu (shown below).

The computer will prompt you to insert your diskette. Put your diskette in drive A and follow the computer's directions.

System	File	Edit	Window
Help... F1			
Calculator			
HMLCCM ▶	Cost Analysis ▶		
	Reference		
	System Maintenance	Back up (floppy)	
	Set Parameters	Up-Load Data	

### 4.3.2 Up-loading data

1. Put a diskette in drive A.

Follow the Computer's directions.

---

#### 4.4 Set parameters

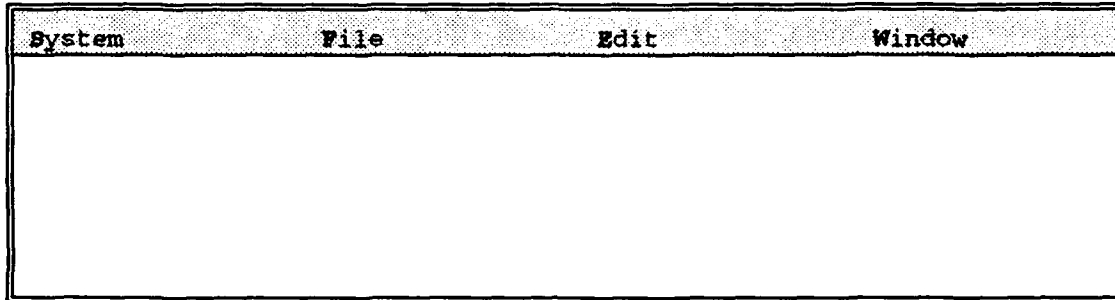
---

To access the set parameters options the user has to provide a password when logging onto the system. For instructions on setting parameters see the system manager's guide.

---

## Section 5 Menus

The HMLCCM commands appear in two Menus; System and File. The Edit and Window menus contain commands that the user will not need to access.

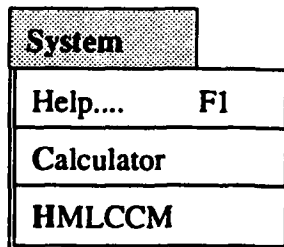


A command is an instruction to your computer to carry out an action, such as printing a document. When you pull down a menu, you will notice that some commands appear in dark text while others are dimmed. You can use the commands in dark text immediately, but you cannot choose a dimmed command until it becomes dark.

### 5.1 The System Menu

---

The System menu contains the commands for logging on the HMLCCM system and the desk accessories such as the Calculator and Help.



#### 5.1.1 Help

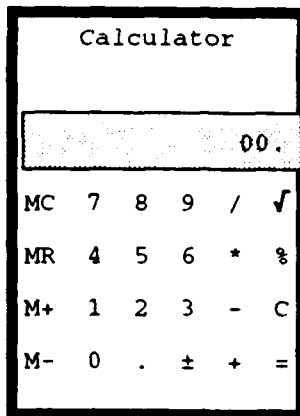
The HMLCCM system offers on-line help. The help contains instructions describing all the HMLCCM functions. To access Help select **Help** from the System menu or press F1. A Help window will display with general topics, commands, and functions. The help window can be scrolled by using the arrow keys on the keypad. To find the topic you want, you can scroll through the list or, while you are in the Help Window, type a letter or series of letter to select the first list item beginning with the specified letter(s).



### 5.1.2 Calculator

The system has a four-function pocket calculator that will appear on the screen when you select calculator from the system menu. The Calculator is used like a standard pocket calculator.

Calculations can be performed using the keyboard or the mouse.



With the keyboard, you can type the equation as it would be written. Most Calculator keys have the same keyboard equivalents, with the following exceptions:

Keystroke	Equivalent
Q	$\sqrt{\quad}$
R	MR
N	$\pm$
A	M+
Z	MC
S	M-

To calculate  $8 \times 16 + 23$  and take the square root of the result using the keyboard:

Type  $8*16+23=Q$  The result is 12.28.

To perform the same calculation with the mouse, simply click on the appropriate numbers and symbols on the Calculator.

---

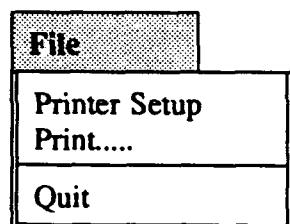
### 5.1.3 HMLCCM

This option allows the users to access the system. The system contains four options which are; Cost Analysis, Reference Materials, System Maintenance, and Set Parameters.

## 5.2 The File Menu

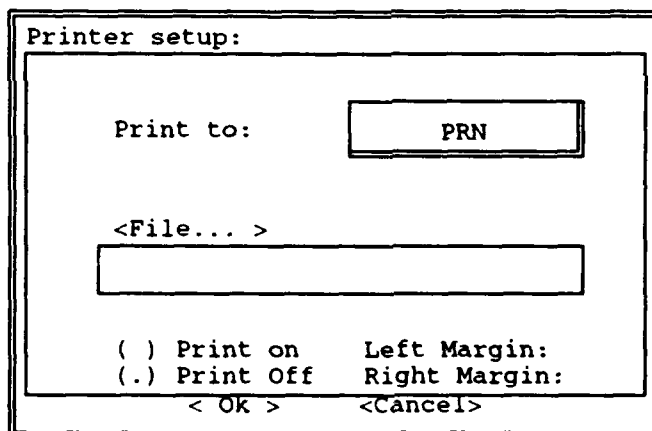
---

The file menu contains the commands for printing documents, and ending a work session.



### 5.2.1 Printer Setup

**Printer Setup...** displays the Printer Setup dialog.



In this dialog, you can choose a print device from the **Print to** popup. If you choose **File** from the popup, you could specify a file to which output will be sent. To do this, type a file name in the text box.

Adjust the settings for left margin and right margin, if necessary.

Choose the **Print on** and **Print off** radio button to enable or disable output to the printer.

---

When your settings are correct, choose **OK** to activate them or choose **Cancel** to exit the dialog without changing the current print settings.

### 5.2.2 Print....

When you select "Print" from the File menu, the Print dialog displays the following menu:

Print:

Windows: File

<File... >

[ ] Line Numbers  
[ ] Page eject before  
[x] Page eject after

< Ok > <Cancel>

Choose the source from the Windows popup. To print the contents of a file that is not currently open, choose the **File** option from the **Windows** popup. Then, in the text box, type the name of the file you want to print.

When the **Line Numbers** check box is checked, HMLCCM automatically adds line numbers to the output.

When the **Page eject before** check box is checked, HMLCCM sends form feed to the printer before printing. When the **Page eject after** check box is checked, HMLCCM sends a form feed to the printer after printing.

Once the settings in the print dialog are correct, choose **OK** to confirm your choices or **Cancel** to exit the dialog without taking action.

### 5.2.3 Quit

Quit ends your HMLCCM session and returns you to the system prompt.

---

## Appendix Terms and Abbreviations

<b>Browse</b>	to display data in a Browse window.
<b>Bootstrap</b>	A method for estimating the variance of a variable from a set of observed values.
<b>Carriage Return &lt;CR&gt;</b>	A command that is usually accessed by the <b>Return</b> key or the <b>Enter</b> key.
<b>Check box</b>	A pair of square brackets followed by text. Settings can be turned on and off by choosing the check box. If a check box has an X in it the setting is on.
<b>Choose</b>	To select a command or an option from a menu, or a control in a dialog.
<b>Default</b>	A preset response to a question or prompt. The default is automatically used by the computer if you don't supply a different response. Default values prevent a program from stalling or crashing if no value is supplied by the user.
<b>Desktop</b>	The screen that underlies all system and user-defined windows is called the desktop.
<b>File</b>	Any name that identifies a file.
<b>Highlight</b>	To make something visually distinct. For example, when you select a block of text, the selected text is highlighted.
<b>Highlighted</b>	Text that is emphasized so that it stands out from the surroundings. Highlighting something typically indicates that it is selected or is about to be chosen. Highlighted text may appear differently depending on the type of monitor and color settings that you use.
<b>HMLCC</b>	Acronym for Hazardous Materials Life-cycle Cost.
<b>HMLCCM</b>	Acronym for Hazardous Materials Life-cycle Cost Model.
<b>HM</b>	Acronym for Hazardous Material.
<b>HW</b>	Acronym for Hazardous Waste.

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<b>Menu</b>	A list of choices presented by a program, from which you can select an option.
<b>Menu bar</b>	A horizontal strip that appears at the top of the screen and contains menu pads.
<b>Menu options</b>	Commands, found on the menu popups, that perform specific actions.
<b>Menu pads</b>	A word, phrase or icon on the menu bar that designates one menu. Positioning the cursor on a menu title highlights the title and display its options below it.
<b>Menu Popup</b>	List of related options. When you choose an option from a menu popup, you are telling the HMLCCM system what action to take.
<b>Menu system</b>	The combination of the menu bar, menu pads, menu popups and menu options.
<b>On-line help</b>	A mini-reference guide, accessible while using the HMLCCM system, that provides additional information about HMLCCM commands and functions.
<b>Options</b>	A list of actions to choose from that are listed on a menu.
<b>Phase</b>	A level in the evolution of a system or product (e.g, construction, or maintenance/repair).
<b>Prompt</b>	A message on the screen that tells you of some need for response or action. A prompt usually takes the form of a symbol, a message, a dialog box or a menu of choices.
<b>Process</b>	The operation or treatment that utilizes the hazardous material described in the scenario.
<b>Radio button</b>	A set of parentheses followed by text. Radio buttons are grouped so that only one can be chosen at a time, like the buttons on a car radio. Choose a radio button to activate it. When a radio button is chosen, a bullet appears in the parentheses and any previously chosen radio button becomes deselected.
<b>Scenario</b>	The specific circumstances that define how a hazardous material is used.
<b>Step</b>	A component of a task that can be defined in terms of the material, process, and personnel that are required to accomplish the task.

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